WHAT IS CLAIMED IS:

1. An apparatus for retaining an electrode plate in a plasma reaction chamber, comprising:

a backing plate having an electrode plate receiving surface;

an electrostatic holding apparatus disposed upon said electrode plate receiving surface, the electrostatic holding apparatus having an electrode plate support surface; and

an electrode plate having a lower surface facing a substrate to be processed and an upper contact surface, the electrostatic holding apparatus being operable to compress the upper contact surface against the electrode plate receiving surface.

2. The apparatus of claim 1, further comprising a mechanical clamping member engaging the outer periphery of the electrode and pressing the upper contact surface against the electrode plate support surface.

3. The apparatus of claim 1, wherein the electrostatic holding apparatus comprises a first dielectric layer, a conductive layer disposed below said first dielectric layer, and a second dielectric layer disposed below said conductive layer, the first and second dielectric layers comprising a compliant material.

4. The apparatus of claim 3, wherein the first and second dielectric layers comprise silicone or polyimide.

5. The apparatus of claim 3, wherein the conductive layer comprises aluminum, copper, titanium, tungsten, molybdenum, nickel, silver, gold, iridium, platinum, ruthenium, ruthenium oxide, graphite, titanium nitride, titanium aluminum nitride, titanium carbide, or combinations thereof.

6. The apparatus of claim 3, further comprising at least one process gas port extending through the first dielectric layer, the conductive layer, and the second dielectric layer.

7. The apparatus of claim 1, wherein the electrostatic holding apparatus has a thickness of 0.005 to 0.015 inches.

8. The apparatus of claim 1, wherein the electrostatic holding apparatus has a bipolar or multipolar design.

9. The apparatus of claim 1, wherein the electrostatic holding apparatus further comprises a resistive heating element.

10. The apparatus of claim 1, wherein the electrode plate comprises a showerhead electrode and the backing plate and electrostatic holding apparatus include at least one process gas port through which process gas can be supplied to the plasma reaction chamber.

11. The apparatus of claim 1, wherein the electrode plate comprises single crystal silicon, graphite, or silicon carbide.

12. The apparatus of claim 1, wherein the electrostatic holding apparatus is in contact with at least 80% of the total surface area of the upper contact surface.

13. A method of assembling a showerhead electrode assembly of a plasma reaction chamber, comprising:

attaching a backing plate having upper and lower surfaces to an electrostatic holding apparatus by bonding an upper surface of the electrostatic holding apparatus to the lower surface of the backing plate;

positioning a showerhead electrode having upper and lower surfaces such that the upper surface faces the lower surface of the electrostatic holding apparatus;

engaging a mechanical clamping member with the outer periphery of the showerhead electrode and pressing an outer portion of the upper surface of the showerhead electrode against an outer portion of the lower surface of the electrostatic holding apparatus; and

applying a voltage to the electrostatic holding apparatus so as to electrostatically attract an inner portion of the upper surface of the showerhead electrode to an inner portion of the lower surface of the electrostatic holding apparatus.

14. The method of claim 13, wherein the electrostatic holding apparatus comprises a first compliant dielectric layer, a conductive layer disposed below said first compliant dielectric layer, and a second compliant dielectric layer disposed below said conductive layer, said second compliant dielectric layer conforming to the upper surface of the showerhead electrode.

15. The method of claim 13, wherein the backing plate, electrostatic holding apparatus, and showerhead electrode include at least one process gas port supplying process gas to the plasma reaction chamber.

16. The method of claim 13, wherein the electrostatic holding apparatus further comprises a resistive heating element heating the showerhead electrode.

17. The method of claim 13, wherein the ratio of contact area between the electrostatic holding apparatus and the showerhead electrode is at least 80%.

18. A method of processing a semiconductor substrate in a plasma reaction chamber, comprising:

transferring a semiconductor substrate into the plasma reaction chamber;

supplying process gas to the plasma reaction chamber through a showerhead electrode; and

applying voltage to an electrostatic holding apparatus which electrostatically clamps the showerhead electrode to a temperature controlled member.

19. The method of claim 18, wherein the method includes etching a layer of material on the semiconductor substrate.

20. The method of claim 18, wherein the method includes etching of a silicon dioxide layer on the semiconductor substrate.

21. The method of claim 18, wherein the method includes depositing a layer of material on the semiconductor substrate.

22. The method of claim 18, wherein the method includes supplying electrical power to a resistive heating element in the electrostatic holding apparatus so as to heat the showerhead electrode.